The '023 patent discloses a method for improving the hardness and strength of frangible and relatively brittle materials by applying mechanical deformation to the material surface. (Col. 1, lines 13-16.) However, the '023 patent fails to teach, disclose or suggest the creating of a plastic deformation within a predefined surface area, of a ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all the claims. The present invention presents significant advantages to the method disclosed in the '023 patent. For instance, the method disclosed in the present invention allows for plastic deformation of a ceramic workpiece without having to raise the temperature of the workpiece above room temperature.

The Examiner has suggested that the '023 patent discloses a process of mechanical deformation of a ceramic at room temperature. However, the method disclosed in the '023 patent will not work for ceramic materials. For instance, the '023 patent teaches the use of, on the one hand, ceramic materials (col. 1, lines 45) and, on the other hand, cemented carbides (col. 1, lines 43-44), also known as cermets which is a compound material consisting of ceramics and metal (combined to form cermet). Cermets have ceramic particles implanted in a metallic matrix structure, whereas ceramic materials consist of inorganic non-metallic substances. The method disclosed in the '023 patent will work for cermets at room temperature. For instance, materials comprising tungsten carbide (a well-known cermet) may be successfully treated by shot peening at room temperature (col. 3, lines 61-63). However, the method disclosed in the '023 patent will not work for ceramics at room temperature. For instance, materials comprising aluminum oxide, a classical ceramic material, must be elevated in temperature prior to shot peening (col. 3, lines 63-65).

Because the '023 patent does not teach, disclose or suggest generating a plastic deformation within a predefined surface area of a ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all the claims, it cannot render the present invention obvious.

The '083 patent deals with a process for modifying the surface of a hard engineering ceramic material (col. 1, lines 5-6). However, the '083 patent fails to teach, disclose or suggest generating a plastic deformation within a predefined surface area of a ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm.

The Examiner has suggested that the '083 patent discloses a process of mechanical deformation of a ceramic at room temperature. However, the method disclosed in the '083 patent will not work for ceramic materials at room temperature. For instance, it is noted that the '083 patent teaches that the process is "preferably . . . at sufficiently high temperature. ..." However, nowhere in the specification does it teach, disclose or suggest that the "sufficiently high temperature" is anywhere near room temperature. Rather, the specification states that "[t]he temperature at which the process is carried out must be less than that at which adhesion and seizure would occur between the surface of the hard engineering ceramics material being treated and the second material applying the point/line loading through processes of bulk diffusion yet high enough to enable significant dislocation mobility. This will usually be in the range of 0.3 Tm to 0.5 Tm." (Col. 2, lines 26-34.) The Tm (melting temperature), of hard engineering ceramics is approximately 1,400°C. Therefore, the '083 patent teaches that the temperature of the hard engineering ceramic workpiece must be elevated to a range that is between 420°C and 700°C which is far beyond room temperature as required by all the claims. In contrast, where a plastic deformation is generated within a predefined surface area of a ceramic material with a tool having a diameter within the range of about .1 mm to 4 mm, the temperature of the ceramic material does not need to be elevated.

Because the '083 patent does not teach, disclose or suggest generating a plastic deformation within a predefined surface area of a ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all the claims, it cannot render the present invention obvious.

The Abstract of JP04108675 discloses a method of applying a mechanical shock to the surface of a material to toughen the material. (JP04108675 abstract.) The Examiner suggests that the Abstract of JP04108675 teaches applying a plastic deformation within a predefined area of the surface. However, the Abstract of JP04108675 discloses subjecting "an alumina sintered form composed of . . . 30wt.% of zirconia" to "mechanical or thermal shock to make the surface tougher than the center." (JP04108675 abstract.) Nowhere does it mention limiting the mechanical shock to a predefined surface area or utilizing a tool having a diameter within the range of about .1 mm to 4 mm. Rather, the Abstract of JP04108675 simply discloses that the surface of the material will be rendered tougher than the center of the material that has not been subjected to the mechanical shock like the surface.

Unlike the method claimed in the present invention, the method taught and disclosed in the Abstract of JP04108675 will not work for ceramics without raising the temperature of the workpiece, unless zirconia is infused into the ceramic workpiece. As stated in the present application, zirconia is a very specialized compound and it is undesirable to have to utilize it in conjunction with all ceramic workpieces to be treated.

Because the Abstract of JP04108675 does not teach, disclose or suggest generating a plastic deformation within a predefined surface area of a ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all the claims, it cannot render the present invention obvious.

The '245 patent also discloses a process of toughening workpieces that "consisting of fine zirconia grains ... primarily of tetragonal zirconia." (Col. 1, lines 33-35) However, the method disclosed in the '245 patent will not work for ceramics at room temperature unless they contain zirconia. As mentioned above, all the claims of the present invention specifically claim a workpiece that "does not comprise Zirconia."

Because the '245 patent does not teach, disclose or suggest generating a plastic deformation within a predefined surface area, of a zirconia-free ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all the claims, it cannot render the present invention obvious.

None of the cited prior art teach, disclose or suggest generating a plastic deformation within a predefined surface area of a workpiece manufactured of a zirconia-free ceramic material at room temperature with a tool having a diameter within the range of about .1 mm to 4 mm as required by all of the claims, therefore none of the cited prior art in any combination can render the present invention obvious.

It is respectfully submitted that claims 1 - 18 all of the claims remaining in the application, are in order for allowance, and early notice to that effect is respectfully requested.

Respectfully submitted,

Wesley W. Whitmyer, Jr., Registration No. 33,558
Todd M. Oberdick, Registration No. 44,268
Attorney for Applicant
ST.ONGE STEWARD JOHNSTON & REENS LLC
986 Bedford Street
Stamford, CT 06905-5619
203 324-6155